Activity 3
Fashion Design: Patterns and Weaving
Solutions

1. a. Students need to find N such that $N(N-1) \leq 500$, and N must be a whole number such that $N(N-1)$ is close to or equal to 500.

Students can solve $N^2 - N - 500 = 0$ using the quadratic formula to get $N = 22.87$. **[QDS note: this equals sign before 22.87 should be an approximate equals, like the one on the page above's equation ending in 17.8 Looks like ~ but with two of them…]**

Take N to equal 22 (largest whole number less than or equal to 22.87). So, there will be 22 threads per block, which is 21 ($N-1$) blocks, and 462 threads (22 times 21). That's 38 short of the full 500 thread warp, so students need to add 19 purple threads to the top of the warp and 19 green thread to the bottom. Now 19 + 462 + 19 gives the full 500 thread warp.

b. Students need to find N such that $N(N-1) \leq 800$, and N must be a whole number such that $N(N-1)$ is close to or equal to 800.

Students can solve $N^2 - N - 800 = 0$ using the quadratic formula to get $N = 28.79$. **[QDS note: this equals sign before 28.79 should be an approximate equals, like the one on the page above's equation ending in 17.8 Looks like ~ but with two of them…]**

Take N to equal 28 (largest whole number less than or equal to 28.79). So, there will be 28 threads per block, which is 27 ($N-1$) blocks, and 756 threads (28 times 27). That's 44 short of the full 800 thread warp, so students need to add 22 purple threads to the top of the warp and 22 green thread to the bottom. Now 22 + 756 + 22 gives the full 800 thread warp.

2. a.

Color Pattern	Block Size # of thread	Number of Blocks	Warp size Total # of threads
PP GG	2	2	4
PPP GPG GGG	3	3	9
PPPP GPPG GGGG	4	3	12
PPPPP GPPPG GGPGG GGGGG	5	4	20
PPPPPP GPPPPG GGPPGG GGGGGG	6	4	24
PPPPPPP GPPPPPG GGPPPGG GGGPGGG GGGGGGG	7	5	35
PPPPPPPP GPPPPPPG GGPPPPGG GGGPPGGG GGGGGGGG	8	5	40

To find a pattern, focus on the odd numbered threads:
3 3
5 4
7 5

b. Use the point-slope formula for two points: $N - 3 = 1/2(x - 3)$, which simplifies to $N = 1/2(x+3)$. So, if N is the number of threads in a block, $1/2(N + 3)$ is the number of blocks, as long as N is odd. If N is even, there are $\text{INT}(1/2(N + 3))$ blocks, where INT is the "greatest integer function" (the function that simply removes the decimal portion of any positive value).

c. The expression that represents the total number of threads is:

$$N\left(\frac{N+3}{2}\right)$$

d. Students need to find the value of *N* that will make the total number of threads nearest to 300:

$$\frac{N^2 + 3N}{2} \leq 300$$

$$N^2 + 3N - 600 \leq 0$$

$$N \approx 23.04$$

So 23 threads is the value, 23(1/2(23 + 3) = 23(13) = 299.

e. 23 threads is one thread short of 300, so students can make up this difference by adding one P thread to the top of the warp or one green thread to the bottom.